PRECIPITATION.

The average monthly precipitation for the State was 0.10 of an inch. This is slightly above the normal.

The following table gives the average and departure from the normal for each July from 1897 to 1911, inclusive:

Years.	Mean.	Departure.	Years.	Mean.	Departure.
	Inches.	*Inches.*		*Inches.*	*Inches.*
1897	0.01	−0.05	1905	0.01	−0.05
1898	T.	− .06	1906	.04	− .02
1899	T.	− .06	1907	.03	− .03
1900	.03	− .03	1908	.04	− .02
1901	.01	− .05	1909	.05	− .01
1902	.70	+ .64	1910	.10	+ .04
1903	.03	− .03	1911	.10	+ .04
1904	.09	+ .03			

The greatest monthly rainfall was 2.50 inches, at Mammoth Tank. One-half of the stations reporting had no rainfall during the month. The distribution of the rain geographically was far from uniform. Afternoon thundershowers in the mountains and a few misting rains along the north coast made up the rainfall.

Snowfall.—No snow was reported at any station in California. There probably were, however, some light falls at elevations above 10,000 feet.

SUNSHINE.

The following table gives the total hours of sunshine and percentages of the possible:

Stations.	Hours.	Percentage of possible.	Stations.	Hours.	Percentage of possible.
Eureka	163	36	Sacramento	414	92
Fresno	421	94	San Diego	251	57
Los Angeles	315	72	San Francisco	264	59
Mount Tamalpais	435	97	San Jose	361	81
Red Bluff	424	93	San Luis Obispo	295	67

THUNDERSTORMS.

Lightning struck Glacier Point in the Yosemite Valley during the afternoon of July 16 and killed 9 out of 18 horses tethered under a tree near the hotel. Over a score of tourists were in the hotel and had just dismounted. The storm was severe in the Wawona section, and the rainfall was so heavy that the Merced River rose to a height of 12 feet and did some damage in the Mariposa Big Tree Grove. On July 14 another thunderstorm and heavy rainfall raised the Merced River 4 feet, causing, it is said, greater flood conditions than during June, when melting snow caused an overflow over a portion of the valley. The flume carrying water to the electric-light station was put out of commission, crippling the power plant and leaving the Valley hotel and camp in darkness on July 14 and until repairs could be made.

On July 15, at El Centro, a storm of some violence, moving from the southeast, struck the section about 3.20 p. m. While the storm lasted only a few minutes, it damaged property to the extent of $30,000. Two lives were lost by falling walls. Many people were injured. The First Presbyterian Church was entirely demolished; the warehouse of the California Cotton Co. collapsed, burying beneath its heavy timbers three Hindoo laborers, two of whom subsequently died. A feed and fuel shed collapsed and several storage and drying sheds and small office buildings, together with some residences, were destroyed.

At Campo thunderstorms and at Sonora rains prevailed from the 3d to the 29th. On the morning of the 27th a severe electrical storm from Campo west to the coast foothills knocked down telegraph poles, killed two mules, and stunned children leaning on fences. In the afternoon a similar storm occurred from Campo east, causing heavy rain in the valleys to the east and on the desert.

At Downieville on the 15th a severe thunderstorm north and northeast was reported, with a cloudburst at Bassetts, causing a rise in the South Fork of the Yuba of about 2 feet.

At Hornbrook on the 24th a heavy thunderstorm with 2 inches of rain occurred, and on the 25th a thunderstorm with a trace of rain.

EARTHQUAKES.

July 1, San Francisco: A severe shock occurred at 2.00:05 p. m. to 2.00:25 p. m., one hundred and twentieth meridian time. It was felt in the Weather Bureau office and the time noted by Observers Scholl and Rogers. No tremulous motion was felt before the principal disturbance, and there was no rocking motion at the end. There were two well-marked vibrations, with an interval of about five seconds. The vertical motion was perceptible, the apparent direction from west to east, and the duration of sensible motion was about 20 seconds. The intensity was No. 7 on the Rossi-Forel scale. No sounds were heard and few objects were overturned.

San Jose, July 1 (Mr. Maurice Connell, observer), reports that one of the severest shocks since the memorable quake of 1906 occurred at 2.00:30 p. m. The movement seemed to be entirely vertical, which would indicate that the locus of the disturbance centered near San Jose. There was a loud roaring-like noise, but the period of active disturbance lasted not over 10 seconds. Damage was not great, plastering being loosened and some brick walls cracked.

Santa Clara, July 1, seismographic station of the Jesuit seismologic service, Rev. J. S. Rickard, S. J., director; Mr. A. J. Newlin, assistant: Most severe shock since April 18, 1906. Tracer thrown off paper, but quickly replaced. Apparently little damage done in this vicinity.

Dr. A. O. Leuschner, professor of astronomy and director of the Students' Observatory, and Mr. Strula Einarsson, instructor in practical astronomy in the University of California, Berkeley, issued a report on the earthquake of July 1, of which the following is a part:

> The earthquake began without preliminary tremor at $2^h\ 00^m\ 28^s \pm$. The period of vertical vibration was approximately 3 seconds, indicating that the center of the earthquake was not as close as one might be tempted to suspect.
>
> The total duration of the motion as shown by the records was roughly 27 minutes, of which 18 minutes were marked by perceptibly strong motion, 10 minutes as heavy motion, and 5 minutes by great intensity. The intensity was 5 on the Rossi-Forel scale; it was a smart shock, generally felt; furniture was shaken, and some clocks were stopped, notably the time clock of the Students' Observatory, this for the first time since the earthquake of April 18, 1906.

NOTE ON EARTHQUAKE OF JULY 1, 1911, AT MOUNT HAMILTON.

The earthquake of July 1, 1911, was in some respects the most severe one experienced since the observatory was founded. The amplitude of vibration was less than

in the shock of April 18, 1906, and the duration was much less but the motion was more violent.

Fortunately the telescopes and other instruments of the observatory suffered no injury, with the exception of the Riefler clock. The steel springs in the pendulum support of this clock were broken, allowing the pendulum to fall and break the airtight glass case. The 36-inch telescope was moved about three-quarters of an inch to the south, the great base plate slipping on the masonry pier. The telescope was put into position again promptly and without difficulty and has suffered no harm whatever.—*Prof. R. G. Aitken, Acting Director, Lick Observatory.*

NOTES ON THE RIVERS OF THE SACRAMENTO AND SAN JOAQUIN WATERSHEDS.

By N. R. TAYLOR, Local Forecaster.

SACRAMENTO WATERSHED.

There was a gradual diminution in the run-off of all streams in this watershed during the month, but all of the important watercourses carried more water than for any corresponding month during the past five years.

In the Sacramento River, above Red Bluff, there was only a slight range between the highest and lowest stages of the month, and in many of the reaches above Redding the river was practically stationary during the last half of the month. From Knights Landing, however, to the tide limits the difference between the stages of the 1st and those of the 31st of the month were more or less marked.

In the Feather-Yuba territory the rivers averaged from 2 to 2.5 feet higher than during the preceding July, and the Yuba River at Marysville was higher than in any July since 1907.

The American River averaged about 1 foot above the usual July stage and was the highest for any like month since 1907. It receded gradually from the 1st to the 31st with a range of 3 feet.

SAN JOAQUIN WATERSHED.

Except the Stanislaus, Mokelumne, and the San Joaquin, in the vicinity of Lathrop, all rivers in this watershed carried more water than for any July since the establishment of Weather Bureau gaging stations in the San Joaquin Valley. The San Joaquin in the vicinity of Firebaugh and Mendota continued above the flood stage until the 8th, but fell rapidly after this date and by the last of the month had fallen nearly 6 feet. Some lands in the vicinity of Mendota were flooded, but all interests were amply protected by the river forecasts from day to day.

PRECIPITATION AND ALTITUDE IN THE SIERRA.

By Mr. CHARLES H. LEE.

NOTE.—This article is published by courtesy of the editor of the Journal of Electricity, Power, and Gas. Mr. Lee, as one of the engineering staff of the Los Angeles Aqueduct, has carried on extensive measurements of rainfall and depth of snow on the eastern side of the high Sierra, in Inyo County, in the watershed of the Owens River. Mr. Lee has been in touch with the Weather Bureau throughout the period covered by these measurements and has in every way tried to further its work.

* * * * *

Precipitation studies made by the Los Angeles Aqueduct officials in connection with a general investigation of water supply conditions in the Owens Valley have led to some interesting results regarding the relation of precipitation and altitude in the Sierra Nevada. The portion of the range considered extends from Lake Tahoe to the Mojave Desert. Data gathered and published by the United States Weather Bureau were used where available and were supplemented on the east slope of the Sierra adjacent to the Owens Valley with records kept by the aqueduct officials. The investigations were carried on by the writer under the direction of William Mulholland, chief engineer of the Los Angeles Aqueduct.

The phenomenon of increase of precipitation with altitude is fully recognized by hydraulic engineers who have had occasion to investigate the subject of precipitation. As a basis for engineering computations the relation is often assumed to be a simple ratio, which may be applied without regard to any factor but difference of elevation. As a matter of fact, however, topography, prevailing winds, latitude, and conditions of the atmosphere have a marked effect upon the geographic distribution of rainfall as well as altitude. The straight line relation, even when used as a convenient approximation, has a limited use, and should not be employed indiscriminately, as is shown by the studies herewith presented.

The general area within which precipitation data were considered is shown by the accompanying map. Upon this are indicated the principal rivers and their drainage area, stream gaging and precipitation stations, and isohyets or lines of equal annual rainfall. The isohyets are those of the Water and Forest Association as amended in 1908 by Edwin Duryea, jr. The dotted isohyets in the southeastern portion of the area are revisions proposed by the writer, based on all data available to date. The southern and eastern extension of the 30-inch and 20-inch isohyets is the most radical change ,and is justified by the aqueduct observations in Owens Valley.

The relations of precipitation and topography are shown in a general manner by the position of the isohyets. A more instructive method is by graphical study of observations made in and near cross sections of the Sierra, laid out at right angles to the trend of the range. Five such were chosen and are shown on the map as the Central Pacific, Mokelumne, Taboose, Oak, and Bairs sections. There are sufficient observations taken along the two most northerly of these to indicate the relations upon both slopes of the range, but records applying to the three southerly sections are confined to the east slope.

A list of stations along the Central Pacific and Mokelumne sections is given in Table 1, together with elevation, distance from the Great Valley, length of record, observed and computed mean seasonal precipitations, and observed precipitations during the season 1909–10. The stations selected were all within 12 miles of the sections, and their elevations were such that they lay in the average profile of ground surface. (See diagrams 3 and 6.) Of stations in the Central Pacific group, Sacramento, Newcastle, Iowa Hill, Reno (1888–89 to 1909–10) and Wadsworth (1890–91 to 1909–10) are maintained by the Weather Bureau. Observations at other stations are made by agents of the Southern Pacific Co. Stations in the Mokelumne group are all maintained by the Weather Bureau. Elevations are those published in Weather Bureau reports, and where possible were compared with those given on Government topographic sheets. Distances from the Great Valley were scaled from the Government topographic or from the general land office map of California. Observed mean seasonal precipitation was computed for the season, September 1 to August 31. The observed means are for periods of differing length, and to obtain values more strictly comparable the records were computed so as to apply to a single definite period. That selected for the Central Pacific group extended over the